US-PAT-NO: 5191701
DOCUMENT-IDENTIFIER: US 5191701 A
TITLE: Method for the automated manufacture of wound electrical components by contacting thin insulated wires to terminal elements on the basis of laser welding
DATE-ISSUED: March 9, 1993
INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Espenhain; Manfred	Heidenheim	N/A	N/A	DEX

US-CL-CURRENT: **29/605**,**219/121.64** ,228/173.5 ,228/179.1 ,29/412 ,29/840 ,29/843 ,29/854

CLAIMS:

I claim as my invention:
1. A method for automated manufacture of wound electrical components wherein thin insulating wires are attached to terminal elements, comprising the steps of:
by **laser welding,** melting only the terminal element so as to form a welding spot by direct laser irradiation at a location desired for the welding; and subsequently embedding the wire into the welding spot as soon as the welding spot has cooled to such an extent that the wire subsequently melts only superficially.

Subsequent step goes beyond class 219 makes application proper for class 29

DIVERSE MANUFACTURING

2. A method according to claim 1 including the step of providing the wire being welded as a copper microlacquer wire which is relatively difficult to solder and is heat resistant.
3. A method according to claim 1 including the step of producing the welding spot at a convex portion of the respective terminal element.
4. A method according to claim 1 including the step of producing the welding spot at a section surface of the respective terminal element.
5. A method for automated manufacture of wound electrical components wherein wires of the electrical components are to be welded to respective terminal elements, comprising the steps of:
providing a continuous standstill-free winding of winding carriers for the wound electrical components wherein the winding carriers are supplied sequentially and step-by-step to a winding mechanism with a conveyor where they are wound and further conveyed;
welding respective wires of each winding to the respective terminal elements of the

winding carriers by first providing a welding spot at a desired location on the respective terminal element by direct laser irradiation, and thereafter embedding the wire into the welding spot as soon as the welding spot has cooled to such an extend that the wire subsequently melts only superficially; and embedding the wire in the welding spot as it is cooling by a winding tension by winding the wire into the welding spot, the weld being formed as the melt thereafter solidifies to form a welded connection.

6. A method according to claim 5 wherein the wire comprises a thin insulated wire.

7. A method according to claim 5 including the step of parting the winding wire between two successive electrical components.

8. A method according to claim 5 wherein the time between the production of the welding spot and the winding of the winding wire into the solidifying melt is set by parameters which define the winding process such that the winding wire will only melt superficially.

9. A method according to claim 5 including the steps of setting a different winding wire length and a corresponding nominal induction value of the wound electrical component via a selection of a geometrical position of the welding spots on the respective terminal elements.

10. A method according to claim 5 including the steps of employing double terminal elements designed in a U-shape which are respectively secured at end faces to two neighboring winding carriers having a rectangular cross section so as to provide a system carrier for the winding carriers, and wherein a welding spot is respectively produced at section surfaces of two U-shaped legs of the double terminal element which point toward an upper side of the winding carriers and which project beyond the winding carriers.

11. A method according to claim 10 wherein the U-shaped legs have window-like recesses which accept correspondingly shaped end faces of the neighboring winding carriers, and wherein the double terminal element is secured to the winding carriers with glue and is held during hardening of the glue by the winding carriers held by a conveyor.

12. A method for contacting thin insulated wires of wound electrical components to terminal elements, comprising the steps of:
melting the terminal element at a location at which the weld is to be performed so

as to form a welding spot by direct laser irradiation; and
as soon as the welding spot has cooled to such an extent that the wire subsequently
melts only superficially, embedding the wire into the welding spot.
13. A method for automated manufacture of wound electrical components wherein wires
of the electrical components are to be welded to respective terminal elements,
comprising steps of:
providing a winding carrier with a respective terminal element;
winding the wire onto the winding carrier;
welding respective wires of the winding to the respective terminal elements by
providing a welding spot at a desired location on the respective terminal elements
by direct laser irradiation, and thereafter embedding the wire into the welding spot
as soon as the welding spot has cooled to such an extent that the wire subsequently
melts only superficially; and
when embedding the wire in the welding spot, utilizing a winding tension by winding
the wire into the welding spot.
14. A method for automated manufacture of wound electrical components wherein wires
of the electrical components are to be welded to respective terminal elements,
comprising the steps of:
providing a series of winding carriers interconnected by terminal elements;
winding wire onto the winding carriers;
welding respective wires of each winding to the respective terminal elements of the
winding carriers by first providing a welding spot at a desired location on the
respective terminal element by direct laser irradiation, and thereafter embedding
the wire into the welding spot as soon as the welding spot is cooled to such an
extent that the wire subsequently melts only superficially;
embedding the wire in the welding spot as it is cooling by a winding tension by
winding the wire into the welding spot; and
cutting the winding carriers apart at each of the terminal elements.

US-PAT-NO: 4580334
DOCUMENT-IDENTIFIER: US 4580334 A
TITLE: Method for manufacturing a commutator
DATE-ISSUED: April 8, 1986
INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
McCracken; William T.	Flint	MI	N/A	N/A
McClaughry; Richard S.	El Cerrito	CA	N/A	N/A
Berry, III; Charles H.	Grand Blanc	MI	N/A	N/A

US-CL-CURRENT: **29/597**,**219/121.63** ,310/233

CLAIMS:

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for making a disk commutator for a vehicle fuel pump driving motor to be operated in a gasoline environment comprising the following steps: holding an annular disk of malleable copper adjacent a matching annular disk of hardened copper alumina, the matching annular disk having superior wear properties in a sour gasoline environment but being subject to possible degradation of these properties if subjected to excessive pressure; **laser welding** the disks in two concentric circles of spot welds, one circle near the inner circumference and one near the outer circumference of the disks; attaching the welded disks to an insulating support; and cutting the disks into commutator segments, each of said segments having at least one spot weld near the inner circumference and at least two near the outer circumference of the disks, whereby the welding and electrical contact of each segment is assured without deformation or degradation of the aforementioned superior qualities.

US-PAT-NO: 4751777
DOCUMENT-IDENTIFIER: US 4751777 A
TITLE: Method for making a full round bushing
DATE-ISSUED: June 21, 1988
INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Savel, III; Frank J.	Cleveland	OH	N/A	N/A

US-CL-CURRENT: **29/898.056**,**219/121.64**

specific article making areas having different class line with close 219. than does 29/592+

Note that claim 14 make case proper for class 148.

CLAIMS:

Having thus described the invention it is now claimed:
1. A method of making a full round bushing comprising the steps of:
supplying a hollow generally cylindrial member having an open longitudinal seam
defined by opposed edges disposed in generally facing relation, said cylindrical
member having at least first and second different metal layers in generally
concentric relation, one of said layers defining a bearing surface; and,
laser welding said opposed edges to form an integral structure wherein said **laser**
welding is essentially limited to the other of said metal layers such that said
bearing surface is not degraded by said welding step.
2. The method as defined in claim 1 wherein said **laser welding** step includes
welding to a depth of approximately 20% to 75% of the radial thickness of said other
of said metal layers.
3. The method as defined in claim 1 wherein said **laser welding** step includes
welding to a depth of approximately 50% of the radial thickness of said other of
said metal layers.
4. The method as defined in claim 1 wherein said **laser welding** step includes
welding with a beam oriented at an angle approximating 10 degrees to 45 degrees to a
radial plane defined between said opposed edges.
5. The method as defined in claim 1 wherein said **laser welding** step includes
welding with a beam oriented at an angle approximating 20 degrees to 25 degrees to a
radial plane defined between said opposed edges.
6. The method as defined in claim 1 wherein said **laser welding** step includes
welding with a beam with its focal point offset from one of said edges a dimension
approximating 5% to 70% of a spot diameter of the laser beam.
7. The method as defined in claim 1 wherein said **laser welding** step

includes
welding with a beam with its focal point offset from one of said edges a dimension
approximating 10% to 30% of a diameter of the laser beam.
8. The method as defined in claim 1 wherein said **laser welding** step includes
forming spot welds which are overlapped approximately 50% to 70% of the spot
diameter of the laser beam.
9. A method of making a full round bushing comprising the steps of:
supplying a multiple layered member having a first layer defining a bearing surface
and a second reinforcing layer;
forming said member into a generally cylindrical configuration in which said first
layer is disposed along an inner peripheral portion thereof and opposed edges are
disposed in close-spaced relation along a longitudinal length thereof; and,
laser welding said opposed edges of said second layer to form an integral structure
wherein said **laser welding** is essentially limited to said second layer wherein said
bearing surface is not degraded by said welding step.
10. The method as defined in claim 11 wherein said **laser welding** step includes
welding to a depth of approximately 20% to 75% of the radial thickness of said
second layer.
11. The method as defined in claim 9 wherein said **laser welding** step includes
welding to a depth of approximately 50% of the radial thickness of said second
layer.
12. The method as defined in claim 9 wherein said **laser welding** step includes
welding with a laser beam disposed at an angle to a radial plane defined between
said opposed edges.
13. The method as defined in claim 9 wherein said **laser welding** step includes
welding at an angle approximating 10.degree. to 45.degree. to a radial plane
defined between said opposed edges.
14. The method as defined in claim 9 further including the step of post-weld
tempering by laser.
15. A bushing made in accordance with the method of claim 11. Proper for Class 148
16. The method as defined in claim 9 wherein said **laser welding** step includes
welding with a beam oriented at an angle approximating 20 degrees to 25 degrees to
said radial plane defined between said opposed edges.
17. The method as defined in claim 9 wherein said **laser welding** step includes
welding with a beam with its focal point offset from one edge of said member a

dimension approximating 5% to 70% of a spot diameter of the laser beam.
18. The method as defined in claim 9 wherein said **laser welding** step includes
welding with a beam with its focal point offset from one edge a dimension
approximating 10% to 30% of a spot diameter of the laser beam.
19. The method as defined in claim 9 wherein said **laser welding** step includes
forming individual spot welds which are overlapped approximately 50% to 70% of the
spot diameter of the laser beam.
20. A method of making full round bushings comprising the steps of:
supplying a multiple layered member having a first layer defining a bearing surface
and a second layer defining a reinforcing metal;
forming said member into a generally cylindrical configuration in which said first
layer is disposed along the inside surface of said member and opposed edges defining
a seam are disposed in close spaced relation along a longitudinal length thereof;
and,
laser welding said opposing edges of said second layer to form an integral structure
using a laser beam which welds to a depth of approximately 20% to 75% of the radial
thickness of said second layer, whereby said bearing surface is not degraded by said
welding step, said laser beam oriented at an angle approximately 10 degrees to 45
degrees to the radial plane defined between said opposing edges and wherein the
focal point of said laser beam is offset from one of said edges a dimension
approximately 5% to 70% of the spot diameter of said laser beam.
21. The method as defined in claim 20 wherein said **laser welding** step includes
welding to a depth of approximately 50% of the radial thickness of said other of
said second layer.
22. The method as defined in claim 20 wherein said **laser welding** step includes
welding with a beam oriented at an angle approximating 20 degrees to 25 degrees to
said radial plane.
23. The method as defined in claim 20 wherein said **laser welding** step includes
welding with a beam with its focal point offset from one of said edges a dimension
approximating 10% to 30% of a spot diameter of the laser beam.
24. The method as defined in claim 20 wherein said **laser welding** step includes
forming individual spot welds which are overlapped approximately 50% to 70% of the
spot diameter of said laser beam.

US-PAT-NO: 5269056
DOCUMENT-IDENTIFIER: US 5269056 A
TITLE: Laser welding of wire strands to an electrode pin
DATE-ISSUED: December 14, 1993
INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Yang; Robert A.	Denver	CO	N/A	N/A
Lynch; David G.	Aurora	CO	N/A	N/A
Sims; Dennis L.	Aurora	CO	N/A	N/A

US-CL-CURRENT: **29/879**,**219/121.63** ,29/860

CLAIMS: Misclassified!! Method claims 10+ control and are proper for class 219 NOT CLASS 29!

Word "assembly" may have confused Examiner!

What is claimed is:
1. An assembly in which multi-strand conducting wire is welded to an end of an electrode pin, comprising:
at least a first laser for providing a first laser energy beam;
means for outputting said first laser energy beam;
means for supporting said means for outputting;
a first conducting wire and a second conducting wire, with each being made of a first material, said first and second conducting wires each having multiple strands and a first end to be welded;
a device having a first electrode pin and a second electrode pin, each of said first and second electrode pins having a free end and being made of a second material different from said first material; and
fixture means for locating said first conducting wire first end adjacent to said free end of said first electrode pin and for locating said second conducting wire first end adjacent to said free end of said second electrode pin, said fixture means including first means that receives each of said first and second conducting wires and maintains uninsulated portions of said first and second conducting wires spaced from each other and including second means that receives each of said first and second electrode pins, said first and second means being substantially aligned such that uninsulated portions of each of said first and second conducting wires are substantially aligned with said free ends of said first and second electrode pins, respectively, said first and second means being substantially continuously fixed in position relative to each other wherein said first means and said second means do not move relative to each other in providing said substantial

alignment, with each
of said first and second conducting wires having a force exerted thereon
substantially no greater than a gravitational force, wherein said first laser energy
beam is directed towards said first conducting wire and said first electrode pin
causing each of said first material and said second material to be melted whereby
said first electrode pin is welded to said first conducting wire.

2. An assembly, as claimed in claim 1, wherein:
at least some of said strands of said first conducting wire first end contact said
free end of said first electrode pin before said first laser energy beam is directed
toward said first conducting wire and said first electrode pin.

3. An assembly, as claimed in claim 1, wherein:
a majority of said melted materials remain within a fusion zone defined by a
diameter of said first conducting wire.

4. An assembly, as claimed in claim 1, wherein:
a second laser energy beam is applied to both of said first and second materials at
substantially the same time as said first laser energy beam.

5. An assembly, as claimed in claim 4, wherein:
each of said first and second laser energy beams is directed substantially
perpendicular to a length of said first electrode pin.

6. An assembly, as claimed in claim 5, wherein:
each of said first and second laser energy beams contacts a different
circumferential section of portions of both said first material and said second
material.

7. An assembly, as claimed in claim 6, wherein:
a third laser energy beam contacts a circumferential section of portions of said
first and second materials with said circumferential section being contacted by said
third laser energy beam being different from each of said circumferential sections
being contacted by said first and second laser energy beams.

8. An assembly in which multi-strand conducting wire is welded to an end of an
electrode pin, comprising:
laser means for providing at least a first laser energy beam;
means for outputting said first laser energy beam;
means for supporting said means for outputting;
first and second conducting wires each including copper, each of said first and
second conducting wires having multiple strands and a first end to be welded;
a device having first and second electrode pins, each of said first and second
electrode pins having a free end and including steel having a different melting
temperature than said copper; and
fixture means for locating each of said first and second conducting wire first ends

adjacent to said free ends of said first and second electrode pins, respectively,
wherein said first laser energy beam is directed toward said first conducting wire
and said first electrode pin, with said first laser energy beam contacting more area
of said first electrode pin having said steel than said first conducting wire having
said copper in simultaneously melting each of said first electrode pin free end and
said first conducting wire first end, with an aiming point of said first laser
energy beam being no greater than about 0.007 inch below said free end of said first
electrode pin and said melting creating a weld between said first electrode pin and
said first conducting wire.
9. An assembly in which multi-strand conducting wire is welded to an end of an
electrode pin, comprising:
laser means for providing a first laser energy beam;
means for outputting said first laser energy beam;
means for supporting said means for outputting;
a first conducting wire and a second conducting wire each being made of a first
material, each of said first and second conducting wires having multiple strands and
a first end to be welded;
a device having a first electrode pin and a second electrode pin, each of said first
and second electrode pins having a free end and being made of a second material
different from said first material; and
fixture means for locating said first conducting wire first end adjacent to said
free end of said first electrode pin and for locating said second conducting wire
first end adjacent to said free end of said second electrode pin, said first end of
said first conducting wire being no greater than about 0.005 inch from said free end
of said first electrode pin when said first laser energy beam is directed towards
said first conducting wire and said first electrode pin, with each of said first and
second materials being melted to provide a weld between said first electrode pin and
said first conducting wire.
10. A method for **laser welding** multi-strand conducting wire to a free end of an
electrode pin, comprising:
providing first and second conducting wires including first ends, with each of said
first and second conducting wires having multiple strands and being made of a first
material;
providing a device having first and second electrode pins including free ends, with

each of said first and second electrode pins being made of a second material
different from said first material;
locating said first conducting wire first end adjacent to said free end of said
first electrode pin;
locating said second conducting wire first end adjacent to said free end of said
second electrode pi;
directing a laser energy beam at different areas of said first end of said first
conducting wire and said free end of said first electrode pin with said laser energy
beam contacting portions of both of said first conducting wire and said free end of
said first electrode pin;
melting substantially all of said first end of said first conducting wire and all of
said free end of said first electrode pin using said laser energy beam;
creating a weld during said step of melting said first end of said first conducting
wire having a weld width defined in a direction substantially parallel to said free
end of said first electrode pin, with said weld width being substantially the same
throughout an entire juncture between said first conducting wire first end and said
first electrode pin free end;
directing a laser energy beam at different areas of said first end of said second
conducting wire and said free end of said second electrode pin, with said laser
energy beam contacting portions of both of said second conducting wire first end and
said second electrode pin free end;
melting substantially all of said first end of said second conducting wire and all
of said free end of said second electrode pin using said laser energy beam; and
creating a weld during said step of melting said first end of said second conducting
wire having a weld width defined in a direction substantially parallel to said free
end of said second electrode pine, with said weld width being substantially the same
throughout an entire juncture between said second conducting wire first end and said
second electrode pin free end.
11. A method, as claimed in claim 10, wherein:
said step of locating said first conducting wire includes contacting at least some
of said strands of said first conducting wire at said first end with said free end
of said first electrode pin.
12. A method, as claimed in claim 10, wherein:
said step of locating said first end of said first conducting wire includes
positioning at least a majority of said first conducting wire strands

at said first
end no greater than about 0.005 inch from said free end of said first electrode pin.

13. A method, as claimed in claim 10, wherein:
said step of directing said laser energy beam at different areas of said first
conducting wire first end includes having more of said laser energy beam contact
said second material than said first material.

14. A method as claimed in claim 13, wherein:
said second material is made substantially of steel and said first material is made
substantially of copper.

15. A method, as claimed in claim 10, wherein:
said step of directing includes providing a number of separate pulses of laser
energy when welding a first conducting wire having at least 30 strands.

16. A method, as claimed in claim 10, wherein:
said step of directing includes providing a number of separate laser energy beam
pulses when welding a first conducting wire having 18 gauge and 41 strands and
providing a single laser energy beam pulse when said conducting wire has 20 gauge
and 20 strands.

17. A method, as claimed in claim 10, wherein:
said step of creating a weld during said step of melting said first end of said
first conducting wire includes maintaining substantially all of said melted
materials within a fusion zone defined by a diameter of said first conducting wire.